

black spot at the anal angle. Head, thorax, and tegulæ silvery grey; antennæ yellowish brown; abdomen greyish fawn-colour; legs grey.

Expanse $2\frac{1}{4}$ inches.

Hab. Costa Rica.

Nystalea sambana, sp. n.

Female.—Primaries dusky grey, with several reddish-brown spots at the apex; a black curved line crosses the wing near the base from the costal to the inner margin; a large silvery-grey patch at the anal angle, extending partly along the inner margin: secondaries pale grey, broadly bordered from the apex to the anal angle by darker grey; the fringe silvery grey. The head, collar, and tegulæ yellowish brown; thorax silvery grey; abdomen dusky grey; underside pale grey; anus yellowish brown.

Expanse $2\frac{3}{4}$ inches.

Hab. Costa Rica.

Nystalea demea, sp. n.

Male.—Primaries greyish fawn-colour; two small black dots at the end of the cell, from which a black line bordered with reddish brown and with a small white streak in the middle extends to the outer margin; a dark brown spot and streak on the inner margin close to the base; several faint brown marks near the anal angle: secondaries dusky fawn-colour, darkest at the apex and round the outer margin; the fringe pale greyish fawn-colour. The head and front of the thorax reddish brown; antennæ yellowish brown; tegulæ and thorax greyish fawn-colour; the base of the abdomen yellowish, the upperside of the abdomen blackish grey, underside paler; the anal tuft greyish fawn-colour.—*Female* very similar to the male, but larger and rather darker in colour.

Expanse, ♂ $2\frac{1}{2}$, ♀ 3 inches.

Hab. Costa Rica.

VII.—*On some new and rare Crustacea from Scotland.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool.

[Plates V. & VI.]

IN the following notes we propose to record some interesting Scotch species of Copepoda, including, among others, a few that appear to be undescribed, and also a curious form

discovered in Germany some years ago by Dr. Poppe, but which has not hitherto been known to occur in the British seas.

Leptosyllus intermedius, sp. nov. (Pl. V. figs. 1-11.)

Description of the Species.—Female. Length $\cdot 58$ millim. ($\frac{1}{4\frac{2}{3}}$ of an inch). Body elongate, slender. Anterior antennæ eight-jointed, short, moderately stout; the first five joints gradually decrease in length, the fifth and sixth are equal; the seventh is shorter than any of the others, while the last is equal to the combined lengths of the two joints immediately preceding. The antennæ are provided with numerous moderately long setæ, and a stout filament springs from the upper distal edge of the fourth joint. The subjoined formula shows the number and proportional lengths of the joints—

Proportional lengths of the joints ..	22	13	10	9	6	6	4	10
Number of the joints	1	2	3	4	5	6	7	8

Posterior antennæ and mouth-organs somewhat similar to those of *Leptosyllus Robertsoni*, T. and A. Scott, but smaller; the end joint of the distal branch of the mandible-palp is also proportionally shorter (fig. 4). The outer and inner branches of the first pair of swimming-feet, which are both two-jointed, are nearly of equal length (fig. 5). The second and third pairs resemble those of *Leptosyllus Robertsoni* (fig. 6). In the fourth pair the outer branches are two- and the inner branches one-, or indistinctly two-jointed (fig. 7). The basal joints of the fifth pair are coalescent and form together a broad lamelliform plate, subtriangular in outline; the margin on each side from the apex to the secondary joint is slightly convex, and immediately behind the secondary joints the margins are produced into broad and somewhat rounded lobes, each lobe being furnished with a moderately stout seta; the secondary joints are very small (fig. 8). Caudal stylets fully twice the length of the last abdominal segment and equal in breadth to nearly half the length; they are each furnished with a terminal spine nearly as long as the stylet (fig. 10). One ovisac containing a few large ova.

Male. The male is similar to the female, except that the anterior antennæ are modified and hinged for grasping, and resemble in structure those of *Leptosyllus Robertsoni*. The basal joints of the fifth pair of thoracic feet, which are also coalescent, are considerably shorter than those of the female, and terminate in two broadly convex lobes, one on each side of the median line; each lobe is fringed with minute hairs; the secondary branches are very small (fig. 9).

Habitat. In pools near low-water mark on the shore at Musselburgh, Firth of Forth; not uncommon.

Remarks. This may be distinguished from any other species of *Leptopsyllus* known to us by the structure of the anterior antennæ and of the fourth and fifth pairs of thoracic feet.

Mesochra spinicauda, sp. n. (Pl. V. figs. 12-25.)

Description of the Species.—*Female.* Length .58 millim. ($\frac{1}{3}$ of an inch). Body elongate, cylindrical, slender. Anterior antennæ slender, rather longer than the first cephalothoracic segment, seven-jointed; the second joint much longer and the fifth shorter than the others. The formula shows the proportional lengths of all the joints—

Proportional lengths of the joints..	6 . 20 . 6 . 8 . 4 . 8 . 11
Number of the joints	1 2 3 4 5 6 7

The first joint of the posterior antennæ is short, the second elongate and nearly twice the length of the last joint; secondary branch very small, articulated to the lower proximal half of the second joint (fig. 15). The mandible-palp consists of a single moderately long narrow joint, which bears a few marginal and terminal setæ (fig. 16). The armature of the maxilla somewhat resembles that of the mandible, and the maxilla-palp is a narrow cylindrical process furnished with a few setæ at its truncate apex and bearing a small lateral lobe, which forms the base of a slender hair. Posterior foot-jaws large; terminal joints very small and forming the base of long slender claws (fig. 19). Inner branches of the first pair of swimming-feet somewhat longer than the outer branches and composed of two nearly equal joints; the first joint of the outer branches is about twice the length of the second, while the second and third are nearly of equal length (fig. 20). The second, third, and fourth pairs are slender and elongate; the inner branches of the fourth pair, which, like those of the preceding pairs, are composed of two nearly equal joints, extend beyond the second joint of the outer branches, and each of the joints bears two minute spines placed widely apart on the inner margin, while the outer margin is partly fringed with small setæ (fig. 21). Fifth pair foliaceous; the inner portion of the basal joints is produced into a subtriangular lobe that extends slightly beyond the secondary joints, and terminates in a stout setiform elongate spine; the inner margin of the basal joints is also provided with a fringe of minute hairs and with a slender seta near the apex; the outer

angles of the same joints are furnished with a long slender seta; the secondary branches are small and bear each four setæ on the outer margin and apex, the apical seta being longer than the others, while the upper two are small (fig. 22). Caudal stylets short; the end of each stylet is prolonged interiorly into a stout spiniform process, and bears a few setæ exteriorly (fig. 24). One ovisac, with a number of moderately large ova.

Male. The male closely resembles the female in general form, but the anterior antennæ are eight-jointed and strongly hinged, the second joint is much longer, and the third and fifth shorter than any of the others. The fifth pair of thoracic feet are nearly as in the female; the sixth pair of appendages (the appendages of the first abdominal segment) are small, subquadrate in outline, and are each armed with a stout spine and two setæ on the apical margin, as shown in the drawing (fig. 23).

Habitat. In pools near low-water on the shore at Musselburgh, Firth of Forth; frequent.

Remarks. The posterior foot-jaws with their extremely long terminal claws form a prominent character in this species and one by which it was readily distinguished from the other Copepoda among which it occurred in the shore-gathering from Musselburgh. The peculiar appearance of the caudal stylets which is represented in the full-sized drawing (fig. 12) is also a marked character; the setæ, as shown in the drawing referred to, extend upwards at an obtuse angle from the terminal spine, to which they seem to be attached when viewed laterally; and this peculiar appearance was observed in all the specimens obtained. The structure of the first pair of swimming-feet resembles somewhat that of the same pair in *Mesochra Robertsoni*, Brady, and in some species of *Attheyella*.

Mesochra MacIntoshi, sp. n.

(Pl. V. figs. 26, 27; Pl. VI. figs. 1-7.)

Description of the Species.—*Female.* Length .6 millim. ($\frac{1}{12}$ of an inch). Body elongate, cylindrical, very slender. Anterior antennæ rather longer than the first cephalothoracic segment, eight-jointed, the penultimate joint being considerably shorter than any of the others, as shown by the formula—

Proportional lengths of the joints . .	11	· 22	· 16	· 11	· 8½	· 8½	· 4	· 9
Number of the joints	1	2	3	4	5	6	7	8

Posterior antennæ three-jointed, second and third joints elongate and subequal, the first short, about half as long as the second; secondary branch very small, one-jointed, and articulated to the lower distal end of the first joint of the primary branch. Mandibles narrow, cylindrical, armed with a few moderately long teeth; basal portion of mandible-palp stout, somewhat dilated, and furnished with a small one-jointed branch at the apex (fig. 4, Pl. VI.). Posterior foot-jaws small, the first two joints moderately stout, the last very small and forming the base of a slender and comparatively short claw (fig. 26, Pl. V.). The first pair of swimming-feet resemble those of *Mesochra Lilljeborgii*, Boeck, except that the end joints of the inner branches are proportionally longer, being equal to about half the length of the first joint (fig. 5, Pl. VI.). Outer branches of the second, third, and fourth pairs elongate; inner branches short, two-jointed (fig. 6, Pl. VI.). Fifth pair foliaceous, small; the basal joints are subquadrangular, and their width equal to nearly twice the length; but the slightly produced inner portion is triangular and furnished with two setæ on the inner margin and one at the apex; secondary joints subquadrate, being nearly as broad as long, and bearing six setæ, arranged at slightly irregular intervals round the outer margin and end; the second seta, counting from the inside, is much longer than any of the others (fig. 7, Pl. VI.). Caudal stylets short, length rather greater than the width, each provided with several setæ, the principal seta being equal to nearly three fourths of the length of the animal.

No males of this species were observed.

Habitat. In pools near low-water mark on the shore at Musselburgh, Firth of Forth; not uncommon.

Remarks. This very slender Copepod does not resemble a typical *Mesochra*, but from its general form seems rather to belong to that peculiar group represented by *Cylindropsyllus* and *Leptopsyllus*. In the structure of its various appendages, however, it is a true *Mesochra*. The first pair of swimming-feet closely resemble those of *Mesochra Lilljeborgii*, differing only in the proportionally greater length of the end-joint of the inner branches. The small clawed posterior foot-jaws and the peculiar form of the fifth pair of thoracic feet are, however, very good and distinct specific characters, independent of the elongate and slender form of the animal.

The species is named in compliment to Prof. W. C. McIntosh, the Scientific Director of the Fishery Board for Scotland.

Pseudowestwoodia pygmæa, sp. n. (Pl. VI. figs. 8-16.)

Description of the Species.—*Female.* Length $\cdot 4$ millim. ($\frac{1}{25}$ of an inch). Very like *Westwoodia nobilis* (Baird) in general appearance, but smaller. Anterior antennæ short, seven-jointed; the first two basal joints are moderately stout, the fourth, fifth, and sixth are subequal in length and much shorter than the others, as shown by the formula—

Proportional lengths of the joints. .	12	12	11	4	4	5	8
Number of the joints	1	2	3	4	5	6	7

Posterior antennæ slender and similar to those of *Pseudowestwoodia Andrewi*, T. Scott*. The basal joint of the mandible-palp is slender and elongate, but the two end-joints are very short and are furnished with several setæ. The maxillæ are small, the distal half is only about half the width of the comparatively broad basal portion, and is armed with several spine-like teeth, while three narrow processes spring from the large notch formed by the sudden contracting of the exterior margin; these processes are subequal in length and reach to about the middle of the biting part; they are each furnished with several small setæ; the two inner processes are also armed with an elongate slender spine (fig. 10). Anterior foot-jaws small, provided with a strong terminal claw, and also with three narrow processes on the distal half of the inner margin, each of which bears a few small terminal setæ (fig. 11). Posterior foot-jaws somewhat similar to those of *Pseudowestwoodia Andrewi*, but rather more robust. The first pair of swimming-feet are also similar to those of that species, but the inner branches have the first joint proportionally longer and are armed with two stout and elongate terminal spines; the longest of the two is about twice the length of the other and fully half as long as the entire length of the inner branch; the end-joint of the inner branches has a pseudo-division extending across the middle of it (fig. 13). The second, third, and fourth pairs are nearly as in *Pseudowestwoodia Andrewi* (fig. 14). Fifth pair small; the basal joint has a somewhat semicircular outline, but the width is greater than the length, and the inner portion is scarcely produced beyond the base of the secondary joint; there are five stout setæ arranged round the distal part of the margin, the middle seta being considerably longer than the others; the exterior angle of the basal joint extends into a narrow

* See 'Twelfth Annual Report of the Fishery Board for Scotland,' part iii. p. 257, pl. ix. figs. 21-29.

process twice as long as broad and furnished with a long slender terminal seta; the secondary joints are small, subovate, with irregular margins, and carry five setæ—one at the apex, one on the inner margin, and three on the outer margin; the apical seta is longer than the others (fig. 15). Caudal stylets very short.

Habitat. Cromarty Firth; near Dunbar, at the mouth of the Firth of Forth; Port Erin, Isle of Man.

Remarks. This small species closely resembles *Pseudowestwoodia Andrewi* in size and in general appearance, but differs distinctly from it in the structure of the anterior antennæ and of the first and fifth feet. It appears to have an extensive distribution.

Pseudowestwoodia major, sp. n. (Pl. VI. figs. 17–20.)

Description of the Species.—Female. Length $\cdot 6$ millim. ($\frac{1}{4\frac{1}{2}}$ of an inch). In general appearance closely resembling the species just described, but larger (fig. 17). Anterior antennæ eight-jointed, the first two stout, the others more slender; the two end-joints are subequal and shorter than any of the other six joints. The proportional lengths of all the joints are shown by the formula—

Proportional lengths of the joints.	15	15	18	12	8	8	5	6
Number of the joints	1	2	3	4	5	6	7	8

The posterior antennæ and mouth-organs are somewhat like those of the last species, but the second joint of the posterior foot-jaws bears a small seta near the middle of the inner margin, and both the outer and inner margins are partially fringed with minute hairs; there are also two setæ at the base of the terminal claw. The first pair of swimming-feet have the first joint of the inner branches proportionally more elongate than that of the same pair in either of the other two species of *Pseudowestwoodia*, the first joint of the inner branches in this species being equal to fully twice the length of the outer branches; the end-joints, like those of the inner branches of the first pair in the species just described, have a pseudodivision across the middle, while the armature of both the inner and outer branches is very strong (fig. 19). The second, third, and fourth pairs are very similar to those in the other two species. Fifth pair large, foliaceous; basal joint nearly as long as broad; the inner portion, which reaches to the extremity of the secondary joint, bears five stout setiferous spines round the broadly and irregularly curved apex; the exterior angle is not produced, but is

bluntly rounded and furnished with one moderately long and a few minute setæ; the basal joint is also fringed with small setæ round the outer margin and end; secondary joint sub-cylindrical and provided with five spiniform and coarsely plumose terminal setæ (fig. 20). Caudal stylets very short.

Habitat. Vicinity of Granton and of Dunbar, Firth of Forth; rare.

Remarks. This species is considerably larger than either of the other two *Pseudowestwoodias*, and hence the specific name we have adopted for it; it differs from both, particularly in the structure of the anterior antennæ and in the form of the fifth pair of swimming-feet; the inner branches of the first pair are also observed to be distinctly more elongate, even without dissection. All the three species closely resemble *Westwoodia nobilis* (Baird) in general appearance, and may, on that account, have been overlooked by students of the Copepoda.

Huntemannia jadensis, S. A. Poppe.
(Pl. VI. figs. 21, 22.)

1884. *Huntemannia jadensis*, Poppe, "Ein neues Copepoden Genus aus der Jade," Abhandl. d. nat. Ver. zu Bremen, Bd. ix. p. 57.

1885. *Huntemannia jadensis*, Poppe, "Die Freilebenden Copepoden des Jadebusens," *op. cit.* Bd. xi. p. 167, Taf. vii. figs. 10-20.

We have much pleasure in recording this curious species for the first time for Britain. It was obtained in brackish pools just beyond high-water mark of ordinary spring tides, at the head of West Loch Tarbert, Argyllshire; several specimens were obtained. These West Loch Tarbert specimens agree in every particular with Dr. Poppe's description and figures, except that the outer branches of the first pair of swimming-feet are three- instead of two-jointed, as shown by our drawing (fig. 22); but this difference may be due to local variation. The anterior antennæ are five-jointed, stout, and strongly setiferous (fig. 21).

The following is Dr. Poppe's definition of the genus:—

"*Huntemannia*, nov. gen.—Körper vollständig gegliedert, mit einem spitz ausgezogenen Rostrum versehen. Vordere Antennen beim ♀ fünfgliedrig, beim ♂ zu Greiforganen umgewandelt. Hintere Antennen zweigliedrig, mit eingliedrigem Nebenast versehen. Erstes Fusspaar zweiästig, von den nachfolgenden Fusspaaren abweichend mit zweigliedrigem Aussenast und eingliedrigem Innenast. Die drei folgenden Fusspaare mit rudimentärem Innen- und zweigliedrigem Aussenaste. Das iii. Fusspaar beim ♂ von dem des ♀ abweichend. Mandibularpalpus einästig. Un-

terer Maxillarfuss schwächig, mit einem Greifhaken versehen. Furcalanhänge beim ♂ und ♀ verschieden gestaltet. Zwei Eiersäcke."

Thalestris mysis, Claus.

This very distinct species was during the last summer observed by us for the first time in the Firth of Forth. The large foliaceous fifth pair of swimming-feet are closely and obliquely striate, the striæ being quite distinct. *Thalestris mysis* appears to be comparatively rare in Britain; there are few Scotch records for it, and its occurrence in the Forth is therefore of interest.

EXPLANATION OF THE PLATES.

PLATE V.

Leptopsyllus intermedius, sp. n.

- Fig.* 1. Female, seen from the side, $\times 80$ (A, front view of ovisac).
 2. Anterior antenna, $\times 500$. 3. Posterior antenna, $\times 500$.
 4. Mandible and palp, $\times 500$. 5. Foot of first pair of swimming-feet, $\times 380$. 6. Foot of second pair, $\times 380$. 7. Foot of fourth pair, $\times 380$. 8. Fifth pair, female, $\times 253$. 9. Fifth pair, male, $\times 253$. 10. Abdomen and caudal stylets, dorsal view, $\times 80$. 11. Male spermatophore, $\times 380$.

Mesochra spinicauda, sp. n.

- Fig.* 12. Female, seen from the side, $\times 80$. 13. Anterior antenna, female, $\times 380$. 14. Anterior antenna, male, $\times 380$. 15. Posterior antenna, $\times 380$. 16. Mandible and palp, $\times 380$. 17. Maxilla, $\times 380$. 18. Anterior foot-jaw, $\times 380$. 19. Posterior foot-jaw, $\times 380$. 20. Foot of first pair of swimming-feet, $\times 380$. 21. Foot of fourth pair, $\times 380$. 22. Foot of fifth pair, female, $\times 380$. 23. Foot of fifth pair, male (A, appendage to first abdominal appendage), $\times 380$. 24. Abdomen and caudal stylets, dorsal view, $\times 80$. 25. Male spermatophore, $\times 380$.

Mesochra MacIntoshi, sp. n.

- Fig.* 26. Posterior foot-jaw, $\times 760$. 27. Abdomen and caudal stylets, dorsal view, $\times 80$.

PLATE VI.

Mesochra MacIntoshi, sp. n.

- Fig.* 1. Female, seen from the side, $\times 80$. 2. Anterior antenna, $\times 253$. 3. Posterior antenna, $\times 253$. 4. Mandible and palp, $\times 380$. 5. Foot of first pair of swimming-feet, $\times 383$. 6. Foot of fourth pair, $\times 253$. 7. Foot of fifth pair, $\times 380$.

Pseudowestwoodia pygmaea, sp. n.

- Fig.* 8. Female, seen from the side, $\times 80$. 9. Anterior antenna, $\times 380$.

10. Maxilla, $\times 380$. 11. Anterior foot-jaw, $\times 380$. 12. Posterior foot-jaw, $\times 380$. 13. Foot of first pair of swimming-feet, $\times 253$. 14. Foot of fourth pair, $\times 253$. 15. Foot of fifth pair, $\times 330$. 16. Abdomen and caudal stylets, dorsal view, $\times 126$.

Pseudowestwoodia major, sp. n.

Fig. 17. Female, seen from the side, $\times 64$. 18. Anterior antenna, $\times 253$. 19. Foot of first pair of swimming-feet, $\times 253$. 20. Foot of fifth pair, $\times 190$.

Huntemannia jadensis, S. A. Poppe.

Fig. 21. Anterior antenna, female, $\times 253$. 22. Foot of first pair of swimming-feet, $\times 253$.

VIII.—*Notes on the Palaeozoic Bivalved Entomostraca.*—
No. XXXI.* *Some Devonian Species.* By Professor T.
RUPERT JONES, F.R.S., F.G.S., &c.

[Plate VII.]

CONTENTS.

- I. Introduction.
- II. Description of the Species.
1. *Aparchites reticulatus*, sp. n., fig. 4.
 2. *Primitia mundula*, var. *sacculus*, nov., fig. 7.
 3. *Primitia nitida* (Roemer), figs. 1 and 2.
 4. *Primitia laevigata*, sp. n., fig. 3.
 5. *Entomis serrulostriata* (Sandberger), fig. 6.
 6. *Barychilina* (?) *semen*, sp. n., fig. 5.
 7. *Beyrichia strictisulcata*, sp. n., fig. 11.
 8. *Bollia varians*, sp. n., figs. 8–10.
 9. *Drepanella serotina*, sp. n., fig. 12.
 10. *Strepulu* (?) *annulata*, sp. n., fig. 13.

I. *Introduction.*

In the 'Jahrbücher des Nassauischen Vereins für Naturkunde,' Jahrgang xlii. 1889, Dr. Fridolin von Sandberger, treating of the lower division of the Devonian System in Nassau, enumerated certain fossil Entomostraca from the Lower Spirifer-Sandstone of Offdillen (or Offdilln), in the north part of the Dillenburg District, at pages 33, 34, 37, 38, and 95, namely:—

* No. XXX. was published in the Ann. & Mag. Nat. Hist. ser. 6, vol. ix. 1892, pp. 302–307.